

say that vortices do not exert some such residual, but uniform, effect on the fluid in which they exist, till second, third, and every other order of small quantities have been taken into account, and the theory of vortices in a perfect fluid worked out with the most final accuracy.

At present, however, the Thomsonian theory of matter is not a verified one, it is, perhaps, little more than a speculation, but it is one that it is well worth knowing about, working at, and inquiring into. It may stand or it may fall, but if it is the case, as I believe it is, that our notions of natural phenomena, though they often fall short, yet never exceed in grandeur the real truth of things, how splendid must be the real nature of matter if the Thomsonian hypothesis turns out to be inadequate and untrue.

I have now endeavoured to introduce you to the simplest conception of the material universe which has yet occurred to man. The conception that is of one universal substance, perfectly homogeneous and continuous and simple in structure, extending to the furthest limits of space of which we have any knowledge, existing equally everywhere. Some portions either at rest or in simple irrotational motion transmitting the undulations which we call light. Other portions in rotational motion, in vortices that is, and differentiated permanently from the rest of the medium by reason of this motion.

These whirling portions constitute what we call matter; their motion gives them rigidity, and of them our bodies and all other material bodies with which we are acquainted are built up.

One continuous substance filling all space: which can vibrate as light; which can be sheared into positive and negative electricity; which in whirls constitutes matter; and which transmits by continuity, and not by impact, every action and reaction of which matter is capable. This is the modern view of the ether and its functions.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Lord Rayleigh has resumed his course of lectures on Electrical Measurements.

Dr. Gaskell's lectures this term deal with the Physiology of the Circulation; Mr. Langley is lecturing on the Physiology of Muscle and Nerve, and the Histology and Pathology of the Secretory Organs.

SCIENTIFIC SERIALS

Transactions of the New York Academy of Sciences, Nos. 2-5, 1881-82.—Outlines of the geology of the North-eastern West India Islands, by Prof. Cleve.—The excavation of the bed of the Kaaterskill, New York, by Dr. Julien.—On the cell-doctrine and the bioplasm doctrine, by Prof. Elsberg.—The discovery of the North Pole practicable, by Commander Cheyne.—The volcanic tufts of Challis, Idaho, and other western localities, by Dr. Jullien.—The mammoth cave of Kentucky, by Mr. Stevens.—On the determination of the heating-surface required in steam pipes employed to produce any required discharge of air through ventilating chimneys, by Prof. Trowbridge.—On a peculiar coal-like transformation of peat, recently discovered at Scranton, Penn., by Prof. Fairchild.—The parallel drift-hills of Western New York, by Dr. Johnson.—Hypothetical high tides as agents of geological action, by Dr. Newberry.—The international time-system, by Prof. Rees. The moral bearing of recent physical theories, by Prof. Martin.—The discovery of emeralds in South Carolina, by Mr. Hidden.—Obituary notice of Prof. J. W. Draper.—On the behaviour of steam in the steam-engine cylinder, and on curves of efficiency, by Prof. Thurston.—Stereoscopic notes, by Prof. Hines.—A new reversible stereoscope, by Mr. Stevens.—Diphenylamine-acrolein, by Prof. Leeds.

Annalen der Physik und Chemie, No. 1, 1883.—On the radiometer, by E. Pringsheim.—A wave-length measurement in the ultra-red solar spectrum, by the same.—Fluorescence according to Stokes' law, by E. Hagenbach.—The isogyrous surfaces of doubly-refractive crystals; general theory of the curves of like direction of vibration, by E. Lommel.—On the heat-conducting power of liquids, by L. Graetz.—On the ratio of the specific heats in gases and vapours, by P. A. Müller.—The product of internal friction and galvanic conduction of liquids is constant with reference to the temperature, by L. Grossmann.—On M.

Guébhard's proposed method of determination of equipotential lines, by H. Meyer.—Further researches on the relation of molecular refraction of liquid compounds to their chemical constitution, by H. Schröder.—On the preservation of oxygen gas in the zinc-gasometer, by J. Loewe.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 11.—“On the Skeleton of the Marsipobranch Fishes. Part I. The Myxinoids (*Myxine* and *Bidellostoma*).” By W. K. Parker, F.R.S. Abstract.

In their crano-facial skeleton the Myxinoids are very remarkable; where segmentation is perfect in other fishy types there they only exhibit a lattice-work of continuous growth; in the median region of the skull-base, where other types show but little or only temporary distinctness of parts, these fishes develop and retain large independent cartilages.

The Lamprey has a large superficial basket-work of soft cartilage (*extra-brachial*), and its gill-pouches keep this related to the rest of the structures of the mouth and throat. But in the Myxinoids the basket-work is *intra-brachial*, and corresponds to the system of segmented arches of the higher Cartilaginous, the Ganoid, and the Osseous fishes. But these non-segmented arches soon lose all relation to the branchial pouches, which are removed so far backwards that they begin under the *twentieth myotome*; whilst the end of the pericardium is under the *fortieth*.

In seeking light upon the primordial condition of the Vertebrates, one naturally looks to such forms as the Myxinoids. For in these types, even in the adult state, there are neither limbs nor vertebrae, and no distinction between head and body, except the beginning, in the head, of a cartilaginous skull; a *continuous structure*—not showing the least sign of secondary segmentation, and by far the greater part of which is in front of the notochord, or axis of the organism. But here our *gradational* work agrees with the *developmental*, for the continuous skull-bars constantly arise before the secondary cartilaginous segments that are found between the myotomes behind the head. Evidently, therefore, the early “Craniata” grew supports to the enlarged and subdivided front end of their neural axis, long before anything beyond strong fibrous septa were developed between the muscular segments of the body. As for the linear growth, the greater or less extension backwards of the main organs—circulatory, respiratory, digestive, urogenital—that, in the evolution of the primary form, was a thing to be determined by the “surroundings” of the type. “Thereafter as they may be” was the tentative idea in this case.

Certainly, in the Marsipobranchs and in their relations, the larval “Anura,” we have the most archaic “Craniata” now existing; in these the organs may be extended far backwards in a vermiform creature, as in these low fishes, or kept well swung beneath the head—the body and tail together forming merely a propelling organ, as is seen in Tadpoles, especially the gigantic Tadpole of *Pseudis*.

Thus we see that in low limbless types there is no necessity for the development of more than fibrous “metameres”; but the vesicular brain, the suctorial lips, the branchial pouches, and the special organs of sense—these all call for support from some tissue more dense than a mere fibrous mat or web. In the Myxinoids we find that four special modifications of the connective tissue series are developed for the support of the properly cephalic organs, and for them only; thus these fishes are *Craniata*, but are not *Vertebrata*; that is, if we stick to the letter, which of course we do not.

At first some disappointment is felt, after careful study of these types, for, notwithstanding the low level in which they remain, they are mere specialised *Ammocetes*, keeping on the same “platform” as the larval Lamprey; yet some parts of their organisation do undergo a marvellous amount of transformation, and are, indeed, as much specialised in conformity with their peculiar habits of life as any *Vertebrates* whatever, the highest not excepted.

Yet, on the whole, the Myxinoids are a sort of *Ammocetinae* type, whilst the transformed *Ammocete*, the larval Lamprey, comes nearest to the untransformed Frog or Toad—the *Tadpole*. But the mere putting of this shows (suggests at any rate) what losses the fauna of the world has sustained during the evolution of the Craniate forms; now, the Myxinoids, Petromyzoids, and anurous Amphibia, must all be kept “within call” of each other; but the types that have been culled out between them

cannot be numbered. Some other kind of fish are evidently the descendants of primordial "Marsipobranchs," notably *Lepidosteus*, the development of which has been lately studied, and the results are being published in the *Philosophical Transactions*. But the *Chimeroids*, *Dipnoi*, and, still more important, the *Myxinoids* themselves, have still to be followed through their early stages. If the present paper is of any value to the morphologist, one on the embryology of these low forms would be worth much more.

The Myxinoids keep on the low "platform" of the larval Lamprey (*Ammocete*) in the following particulars, namely :—

a. The notochord has no paired cartilaginous vertebral rudiments in the spinal region.

b. The trabeculae end in the ethnoidal region, without growing forwards into a cornu (or *two continuous cornua*).

c. There are merely "barbels" round the mouth; no *labial cartilages*.

d. The last character involves this, namely, that the special armature of horny teeth, attached to the labials in the adult *Petromyzon*, is absent.

e. The organs of vision are very feeble, and probably almost useless; in the *Ammocete* they are arrested for a time.

f. The cranium is a mere *floor*, without side-walls or roof.

The Myxinoids come near to the adult Lamprey in the following particulars, namely :—

a. There are developed outside the skull proper, but not segmented from it, palato-pterygoid and hyoid cartilages.

b. There is a very large median cartilage belonging to both the hyoid and branchial regions.

c. The cranium acquires a floor by the development of a special "hinder intertrabecula."

d. There is a large median cartilaginous olfactory capsule.

The Myxinoids go beyond even the adult Lamprey in the following particulars, namely :—

a. The facial basket-work is much more perfect; and as this is a generalised condition of the true *intra-visceral* system of cartilages, it is a very important character; there is not only an equal development of the "suspensorium," but the *suspensorial part* of the hyoid is developed also (it is suppressed in the Lamprey); and there is, in *Bdellostoma* a large complete first branchial arch, and in both kinds pharyngo-branchial rudiments of the second branchial arch.

b. The respiratory (branchial) pouches are much more specialised by being carried far back under the spine.

c. There is not only a distinct sub-cranial intertrabecula, but also a large pre-cranial or nasal median cartilage of the same nature.

d. The opening of the median olfactory sac is not a mere short membranous passage, but a long tube, encased in a series of cartilaginous (imperfect) rings.

e. Correlated with the non-development of the suctorial labial cartilages, there is an enormous development of the lingual, the basal bar becoming not only double, but, in front, quadruple, and the "supra-lingual" cartilages, which are very small in the Lamprey, and carry only one pair of rows of small second teeth, in the Myxinoids are very large, and carry two pairs of rows of large teeth, with the addition of a median antagonistic "ethnoidal tooth."

Lastly, the greater development of the intra-visceral (= "intrapranchial") cartilages is correlated with the suppression of the extra-visceral basket-work seen both in the larval and adult Lamprey, and also in the larvae of the "Anura" generally.

January 18.—"On the Skeleton of the Marsipobranch Fishes. Part II. The Lamprey." By W. K. Parker, F.R.S.

The suctorial mouth has its highest development in the Lamprey; in the Myxinoids (*Myxine*), and *Bdellostoma*, there is no circular disk with horny teeth, but merely an oral fissure surrounded by barbels, and having inside it a huge tongue beset with two oblique rows of recurved and inturned horny teeth, antagonised by a single ethnoidal tooth. In the larva of the Lamprey the mouth is not circular, and the *lower lip* is far back, covered by the *upper*, which is like a hood; there are no teeth of any kind, only moss-like "barbels" or *papillæ* under the upper lip.

In the Tadpole the mouth is suctorial, the *lower lip* being converted into an imperfect ring, which is completed by the *upper* lip. Here the cartilage of the lower lip is not a perfect ring, as in the Lamprey, but is in two parts, and is formed into a sort of horseshoe. Inside this compound ring there are sharp horny

plates or teeth, and the folds of the lips, all round the mouth, are covered with a horny rasp.

Correlated with the perfectly suctorial *lower lip* of the Lamprey, which, is a *post-oral* structure, entirely, we have the perfectest form of the superficial branchial skeleton, a basket-work of soft cartilage which appears in the early embryo, and only gains enlargement fore and aft, and all its snags and out-growths, after metamorphosis. Besides this there are no rudiments of *internal* branchial arches, such as we find in the Tadpole. The only parts developed *inside* the head-cavities and branchial arches are the generalised and rudimentary mandibular and hyoid arches. In the Tadpole there is no *pier* to the hyoid arch, and the *first cleft* is arrested as a small blind pouch; this state is persistent in the Lamprey. But, after metamorphosis—as the lingering latter part of that profound change of structure—the young Frog and Toad acquire a pier to their hyoid arch, right and left. This, however, does not become functional to the arch, much less assist in supporting the mandible, as a "hyomandibular," but is transformed into an osseous-cartilaginous chain—a *stapedio-incudal* series, specialised comparatively with the expanded rudiment of the first cleft, now enlarged into a *cavum tympani*, with a large "Eustachian opening." The little mandibles of the Tadpole, which served as arms to carry the divided suctorial disk, and lay across the fore face, become very long, and are often hinged on to their pier behind the occiput, and the cartilages of the suctorial disk straighten out and add to the length of the lower jaw in front. These things show how this temporary "Petromyzoid," the Tadpole, blossoms out into unthought-of specialisations; it becomes a *quasi-reptile*, worthy of a place far above the Lamprey, and even far above all other *Ichthyopsida*.

Geological Society, January 10.—J. W. Hulke, F.R.S., president in the chair.—T. W. Edgeworth David, the Earl of Dysart, John James Hamilton, Francis Alfred Lucas, and Meaburn Staniland, were elected Fellows, and Dr. Otto Torell, F.C.G.S., of Stockholm, a Foreign Member of the Society.—The following communications were read:—On the Lower Eocene section between Reculvers and Herne Bay, and some modifications in the classification of the Lower London Tertiaries, by J. S. Gardner, F.G.S.—The author noticed Prof. Prestwich's classification of the Lower London Tertiaries, and the introduction by the Survey of the term "Oldhaven Beds" for some of his basement beds of the London Clay. He next discussed the conditions under which the Lower Tertiaries were produced, and showed that throughout the Eocenes there are indications of the close proximity of land and of the access of fresh water. Two types of faunas are to be recognised, namely, those of the Calcaire Grossier and the London Clay, the latter indicating more temperate climatal conditions. The former is represented in England by the Bracklesham series. The areas of these two faunas were separated by land forming an isthmus, as each formation is bounded by a shore-line and separated from its neighbours by freshwater formations; but this isthmus probably shifted its position to the north and south without ever being broken through. A vast Eocene river existed, draining a great continent stretching westward; the indications of this river in Hampshire and Dorsetshire would show it to have been there seventeen or eighteen miles wide.—The Lower Tertiaries have been divided by Prof. Prestwich and the Survey into the marine Thanet beds, the fluviatile, estuarine and marine Woolwich and Reading Beds, and the marine Oldhaven Beds. The mode of occurrence of these was described by the author, with especial reference to the section between Herne Bay and the Reculvers, from his investigation of which he was led to the following conclusions:—The Thanet Sands were probably deposited by a rough sea outside the estuary of the great Eocene river, but within its influence. This area became silted up, rose above the surface, and became covered with shingle and sand. The Thanet Beds closed with a period of elevation, during which the Reading Beds were formed, and this was followed by a subsidence during the Woolwich period, which finally ushered in the Oldhaven and London Clay deposits. The formation of the Oldhaven Beds may be compared with that of the modern beach at Shellness; and during the period of depression the beaches would advance steadily over the flat area of Sheppey, and the earlier formed ones would sink and become covered up by the silt of the great Eocene river. These beaches, forming vast aggregations of sand and shingle between the Thanet Beds and the London Clay, form integral portions of one or other formation, and cannot be recognised as forming a separate

formation at all equivalent to the other divisions of the Eocene.—On Mr. Dunn's Notes on the Diamond-fields of South Africa, 1880, by Francis Oates, F.G.S.

Anthropological Institute, January 23.—Anniversary Meeting.—John Evans, V.P., D.C.L., F.R.S., in the chair.—The Treasurer's report and the report of the Council were read and adopted.—The Chairman delivered an address, in which he briefly reviewed the work of the past year, and enlarged on the subject of the antiquity of man, discussing the evidence for and against his existence in Tertiary times.—The following Officers and Council for 1883 were elected:—President, Prof. W. H. Flower, F.R.S. Vice-presidents: Hyde Clarke, John Evans, F.R.S., Francis Galton, F.R.S., Major-Gen. Pitt-Rivers, F.R.S., A. Thomson, F.R.S., E. B. Tyler, F.R.S. Director, F. W. Rudler, F.G.S. Treasurer, F. G. H. Price, F.S.A. Council: J. Beddoe, F.R.S., S. E. B. Bouvier-Pusey, E. W. Brabrook, F.S.A., C. H. E. Carmichael, M.A., W. Boyd Dawkins, F.R.S., W. L. Distant, A. W. Franks, F.R.S., Lieut.-Col. H. H. Godwin-Austen, F.R.S., Prof. Huxley, F.R.S., A. H. Keane, B.A., A. L. Lewis, Sir J. Lubbock, M.P., R. Biddulph Martin, M.P., Henry Muirhead, M.D., J. E. Price, F.S.A., Lord Arthur Russell, M.P., Prof. G. D. Thane, Alfred Tyler, F.G.S., M. J. Walhouse, F.R.A.S., R. Worsley.

PARIS

Academy of Sciences, January 22.—M. Blanchard in the chair.—The following papers were read:—On metasulphites, by M. Berthelot.—On selenide of nitrogen, by MM. Berthelot and Vieille.—On the characters of induced currents resulting from reciprocal movements of two magnetic bodies parallel to their axis, by M. du Morcel. Polarisation of an iron core immobilises a certain quantity of magnetism, which thus remains indifferent to exterior magnetic excitation, and is only affected when, being able to act on the inducing body, which over-excites its energy, it may polarise it in its turn, so that action and reaction are in concordance.—On complex units (continued), by M. Kronecker.—Theory of the most general electro-dynamic actions that can be observed, by M. Le Cordier.—On the construction of a dynamo-electric propeller on a long balloon, by M. Tissandier. The system, with a total weight = three men, gives during three hours the work of twelve to fifteen men. The two-vaned propeller (of steel wire and varnished silk) is driven by a small Siemens' dynamo (120 turns of the former to 1200 of the latter); the battery being of thirty-four elements mounted in tension, and divided into four series. An element consists of a vulcanite box (four litres capacity) holding ten zinc and eleven carbon plates. Strong bichromate solution is let in or drawn off by raising or lowering a separate vessel connected by a tube with the battery.—Observations of the transit of Venus at Bragado (Argentine Republic), by M. Perrin. He observed two direct contacts (the second and the fourth), and a certain number of artificial contacts which will supplement the others. The phenomenon was of distinct and well characterised geometrical appearance.—On the approaching return of the periodic comet of d'Arrest, by M. Leveau. He has calculated an ephemeris (which will be communicated to all astronomers) for the period most favourable to observation, viz. April 23 to November 25 this year. Values for the relative brightness are deduced.—Addition to a note on prime numbers, by M. de Jonquieres.—On the relations between covariants and invariants of like character, of a binary form of the sixth order, by M. Stephanos.—On the functions of several imaginary variables, by M. Combescure.—On the functions of two variables, by M. Poincaré.—On the curves of the sextant, by M. Gruey.—Mode of distribution among various points of its small supporting base, of the weight of a hard body, of polished and convex surface, placed on an elastic horizontal ground, by M. Boussinesq.—On a communication of MM. Mercadier and Vaschy on consequences deducible from relations between electric magnitudes, by M. Lévy.—Remarks on the expression of electric magnitudes &c. (continued), by MM. Mercadier and Vaschy.—Observations on Dr. Siemens' last paper, by M. Violle.—Photographic positives on paper obtained directly, by MM. Cros and Vorgerand. Paper is covered with a solution of 2 gr. bichromate of ammonia, 15 gr. glucose, and 100 gr. water, is dried, and exposed to light under a positive (e.g. a drawing). When the (yellow) bare parts of the paper have become grey, the paper is immersed in a bath of 1 gr. nitrate of silver to 100 gr. of water, with 10 gr. acetic acid. The image appears at once, with reddish tint, produced by bichromate of silver. Drying in light gives a dark brown tint.

—On hydraulic silica, by M. Le Chatelier. The only new fact given by M. Landrin (he says) is the non-hydraulicity of silica obtained from manufacture of hydrofluosilicic acid.—On mutual displacements of bases in neutral salts, the systems remaining homogeneous, by M. Menschutkin.—On the causes capable of affecting the amount of ammonia in rain-water, by M. Houzeau. One important consideration is the time that has elapsed between obtaining and analysing; another the monthly quantity of water (the less the rain, the more ammonia present).—On the action of certain metals on oils, by M. Livache. Instead of metallic plates (which M. Chevreul experimented with), he used metals finely divided, as in precipitation, and got much better effects. Of the three, lead, copper, tin—lead acts most strongly. If some of it be moistened with oil and exposed to air, an increase of weight very soon occurs through oxidation, and it is greater the more siccative the oil. A solid and elastic product is formed. The increments of weight with different oils are sensibly proportional to those in fatty acids of the same oils exposed to air several months (cotton-seed oil alone is anomalous; it is siccative, but its fatty acids increase very little in weight). The transformation of the oil is attributed to direct action of the metal, not to that of the air. It suggests a rapid means of distinguishing siccative and non-siccative oils, and an advantageous substitute for the heating of oils.—Calcification of kidneys, parallel to the decalcification of the bones, in subacute poisoning by corrosive sublimate; increase of the proportion of mineral parts of a tibia, following disarticulation of the other tib'a, by MM. Prevost and Frutiger.—Physiological action of sulphate of quinine on the circulatory apparatus in men and animals, by MM. Lée and Bochefontaine. It preserves and increases the force of the heart, and is a powerful antipyretic.—Medullary origin of paralyses following cerebral lesions, by M. Couty.—On the lymphatic system of tadpoles, by M. Jourdain.—On the development of the reproductive apparatus of pulmonate molluscs, by M. Rouzaud.—On Sucticiliata Infusoria (a reply), by M. de Merejkowsky.—On the morphological nature of the subterranean branches of the root of adult *Psilotum*, by M. Bertrand.—Contribution to the stratigraphic history of the relief of Sinai, and especially on the age of porphyries of that country, by Abbé Raboisson. The last dislocations of the Sinaitic system were posterior to the eocene.

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